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Adults' resistance to learn in school versus adults' competences in work: the case of mathematics

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Abstract
The set of conflicts between constraints and needs is a background to adults' learning and non-learning in 'late modern' society, which must be taken into account if we want to investigate adults' resistance to learn. In adult education, resistance is a well known phenomenon. There is an apparent contradiction between many adults' problematic relationships with mathematics in formal settings and their mathematics-containing competences in everyday life. However, there is very little research done on the subject, and resistance is often explained purely as a lack of motivation and the symptom as non-learning. In this paper people's resistance is seen as interrelated with their motivation and competence and thus containing a learning potential even for supplantive learning.

Introduction

The perspective in the idea of lifelong learning structuring today's educational system demands a rupture with the limited conception of learning and knowledge. Individual and collective learning processes don't only take place as schooling within formal education, and the focus has to be moved from teaching to learning in the workplace and in everyday life. (Olesen, 2002). This is also the case when learning mathematics is on the agenda. However, when the issue is mathematics there is a specific problematic. Adults develop to a great extent their mathematics-containing competences and qualifications through participation in communities of everyday practice (see, for an example, FitzSimons and Wedege, 2004). Nevertheless, it appears that their beliefs about mathematics are primarily related to their school experiences, and mathematics is experienced by many adults as something that others can do, but that they themselves can neither do nor need (Coben, 2000; Wedege, 2002). People's everyday competences do not count as mathematics (FitzSimons, 2002) and the subjective relevance of the school subject mathematics is questioned by many individuals within and outside of the educational system. The phenomenon of coexistence of the social significance of mathematics, with the invisibility and irrelevance subjectively felt by many, has been named “the relevance paradox” (Jensen, Niss and Wedege, 1998). But maybe this is only a paradox in the world of the mathematics teacher. When people reply that they don’t use and don’t need mathematics in every day life, they may refer to school mathematics, not to “mathematics at work” (Wedege, 2002, 2004).

From the perspective of lifelong learning, education is experienced by adults as a field of tension between felt needs concerning what one wants to learn – or has to learn – and constraints (Illeris, 2003a). This set of conflicts is a background to adults’ learning processes in 'late modern' society, which we must take into account if we want to discuss adults’ motivation and resistance to learn. The objective of the ongoing research project “Adults learning mathematics in school and everyday life” is to establish an interdisciplinary theoretical framework to describe, analyse and understand the conditions of adults’ learning processes – including social and affective aspects (see http://mmf.ruc.dk/~tiw). We conduct this research both within the frame of formal adult mathematics education (*school*) and as informal mathematics learning in communities of everyday practice (*work*). This paper is based on international networking in this project and more specifically on the working paper “Motivation and resistance to learning mathematics in a lifelong perspective” where we present and discuss motivation and resistance as interrelated phenomena. (Evans and Wedege, 2004).

In this paper, adult’s resistance to learn in school deals with phenomena within education not with enrolment problems or adults’ barriers to return to mathematics education. The work presented is based on the assumption that people’s relationship with mathematics has three analytical aspects: cognitive, affective and social. The focus is on the last two, and it is argued that inter-disciplinarity is necessary in the research domain of adult mathematics education in and for the workplace. Three phenomena in adult mathematics education are presented as interconnected also to the perspective of resistance. Literature concerning resistance in adult education is briefly reviewed and finally two examples of interconnected motivation and resistance in two women’s lives are analysed.

Three dimensions of adults’ learning

We find a general framework for understanding adults’ learning in Knud Illeris (1999 and 2003b) who has combined a variety of learning theories into a comprehensive theory based on two fundamental assumptions: (1) All learning includes two basic processes: an external interaction process between the learner and his or her social, cultural and material environment, and an internal psychological process of acquisition and elaboration. (2) All learning includes three dimensions embedded in a societally situated context: the cognitive dimension of knowledge and skills, the emotional dimension of feelings and motivation, and the social dimension of communication and co-operation.

In his model construction of the field of learning (Figure 1), Illeris represents the external process as a double arrow between the social, cultural or material environment and the individual (the specific learner) and the internal psychological process of acquisition and elaboration as another double arrow. The two arrows span out a triangular field, and it is the core claim of the theory that all learning always involves these three dimensions. In this model or framework, the cognitive dimension refers to the learning content (knowledge and skills). The affective, emotional or psychodynamic dimension encompasses mental energy, feelings and motivations. The social dimension is the dimension of external interaction, e.g. participation, communication and co-operation.

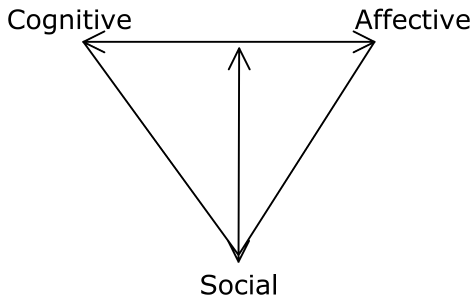

Figure 1. Three dimensions of the learning process.
Source: Illeris, (2003b: 400, Figure 2)

We find this a useful basis for our work to say that people's relationship to mathematics can be analysed in these three aspects: cognitive, affective and social /environmental, remembering that a specific socio-cultural context is always setting the basic conditions for the learning processes. This theoretical choice illustrates the need of interdisciplinary work in our field.

Inter-disciplinarity is necessary[1]

The research domain "adults' mathematics in and for the workplace" is being cultivated in the borderland between research in mathematics education and in adult education, from where we import and reconstruct concepts, theories, methods and findings, like the theoretical framework presented above (Wedege, 1998). In the book "What counts as mathematics?", Gail FitzSimons is seeing her work on the borderlands of three fields: mathematics education, adult education and vocational education – connecting all three. And she continues: "Perhaps it is due to these borderland crossings that my research is often located at the margins of each of these research communities." (FitzSimons, 2002:2). In this no-man's land, the construction or reconstruction of conceptual frameworks are important tasks in research. Lave's theory of situated learning and Engeström's theory of expansive learning are two examples of general theories that have been used and re-interpreted in studies of adults' mathematics in work (Wedege, 1999; FitzSimons, 2002).

Research in adult and mathematics education

The subject area of adult education encompasses formal adult mathematics education as well as adults' informal mathematics learning in the communities of everyday

[1] This section is a shortened and edited version of "Identity of the research domain" in Wedege, 2004.

practice, e.g. the workplace. The development of adult education research to an independent academic field is closely associated with the institutionalisation of adult learning. But, although the development of the field of practice is an important criterion for relevance, this is not just the ability of research to answer the problems in the field of practice, but also to criticise and reformulate these problems (Olesen and Rasmussen, 1996). Within the field of mathematics education research, relevance to the practice of teaching or learning mathematics is also a criterion of quality. The subject field is constituted by the problem field of mathematics education "in all its complexity". Which means that the subject area is "always-already" structured and delimited by the concrete forms of practice and knowledge that are currently regarded as mathematics teaching, mathematics learning and mathematics knowing. However, a critical perspective might be opened up when studies concern the functions of mathematics education in society and in people's lives (Wedege, 2000).

It is an important part of the self-conception in the research field of adult education that it cannot be subordinated in a disciplinary context (such as a sub-discipline in pedagogy, psychology or sociology), but that inter-disciplinarity is a significant feature (Olesen and Rasmussen, 1996). The field of mathematics education research also makes use of concepts, methods and results from other disciplines (psychology, sociology, linguistics, anthropology, philosophy). In the beginning, the studies were *multi-disciplinary*. The original approach in research was to deduce the consequences for mathematics education from findings in the other disciplines, especially psychology. To create *inter-disciplinarity* the imported conceptual frameworks have to be derived and modified (Brousseau, 1986). In adult vocational and further education, the reasons for teaching and learning mathematics are to be found outside mathematics. That is another reason why inter-disciplinarity is essential, both in education and research, and reconstruction of conceptual and theoretical frameworks from other disciplines is a central task (Wedege, 2000). In addition, mathematics education research has a specific relationship to mathematics as a scientific discipline, as a social phenomenon, and as a school subject (Niss, 1994). What is recognized as mathematics, and what is not, is important to research, and it is also a political question; a question about mathematics and power (Mellin-Olsen, 1987; FitzSimons, 2002).

In Danish adult education research and development, in the late 1980s and the 1990s, the theoretical construction of a general qualification concept was a driving force as adult education is closely connected with work as an individual and a social phenomenon (Olesen, 1994). Today the term 'competence' is almost hegemonic in educational discourses. In order to study the relation between vocational mathematics education and mathematics at work, Wedege (2000) has imported and reconstructed the concept of qualification, in which a dualism is incorporated - qualification is seen both as a characteristic of the requirements for skills and abilities of the job function and as a characteristic of the skills and abilities of the (potentially) working person. After reconnaissance in adult mathematics education research, Wedege has claimed that two different lines of approach are possible *and* necessary: *the objective approach* (the labour market's requirements with regard to mathematics knowledge), and *the subjective approach* (adults' need for mathematics knowledge in their present and future workplaces).

Research combining adults, mathematics and society in workplace studies opens up the possibilities of making the adults' mathematics visible in their competences at the workplace, and making mathematics visible in the qualifications demanded from the labour market. This could be the basis of studying adults' motivation and resistance to learn mathematics as interrelated phenomena in a field of tension between constraints and needs.

Motivation and resistance in mathematics education

In the triangular framework (Figure 1), we can locate motivation and resistance – understood as conditions for people's learning and non-learning – as part of the affective dimension. Much relevant work on affect in a broad sense has been done in the field of mathematics education (see for example Evans, 2000). According to McLeod's (1992) review, beliefs, attitudes, and emotions are used to describe a wide range of affective responses to mathematics. These three terms are not easy to distinguish but they vary in stability: beliefs and attitudes are generally stable, but emotions may change rapidly. They also vary in level of intensity of the affect that they describe, increasing in intensity from "cold" beliefs about mathematics, to "cool" attitudes related to liking or disliking mathematics, to "hot" emotional reactions to the frustrations of solving non-routine problems. McLeod also distinguishes beliefs, attitudes, and emotions to the degree to which cognition plays a role, and the time they take to develop. They have been positioned along a spectrum that runs from *stability* and "cool" on the left, to fluidity and *intensity* on the right; see Figure 2.

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Beliefs                        Attitudes                        Emotion
<------------------------------------------------------------------------>
Stability                                                        Intensity
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Figure 2. Spectrum of Types of Affect
Sources: McLeod (1992), Evans (2002)

In this model *beliefs* include self-perception (e.g. "Mathematics - that's what I can't do."), aspects of 'identity' (e.g. "We - the semi-skilled workers - not using mathematics versus "the others" using mathematics), and confidence; *attitudes* (e.g. maths anxiety) are more stable than *emotions* (e.g. panic or joy) (see Wedege, 2002).

When we turn to motivation and resistance, not so much relevant work has been done, to date, in mathematics education. Neither the term "motivation" nor the term "resistance" are to be found in the subject index of the first and the second international handbooks of mathematics education (Bishop et al., 1996 and 2003). According to Markku Hannula (2004), who has summarised the work, motivation has been discussed in mathematics education under the terms motivational orientation, interest and motivational beliefs. He surveys some important distinctions made in psychological approaches to educational contexts: intrinsic motivation (rewarding in itself) vs. extrinsic motivation (offering an outside reward), and that between *learning (or mastery) goals*, *performance (self-enhancing) goals* ("I will raise my math mark") and *ego-defensive (avoidance) goals* ("You don't need math in life"). Mastery and performance are usually seen as competing motivational orientations but, in this research in mathematics classrooms, Hannula finds that they rather as goals are supporting each other.

From a socio-cultural approach, Stieg Mellin-Olsen (1987) developed concepts of social rationale (S-rationale) and of instrumental rationale (I-rationale) for learning mathematics, which might be seen as a parallel to the psychological concepts intrinsic and extrinsic motivation. Mellin-Olsen distinguishes between two rationales that on most occasions may well both be present. The *S-rationale* is evoked in a student by a synthesis of his self-concept, his cognition of school and schooling, and his concept of what is significant knowledge – according to his norms – and of possible future value. The *I-rationale* is related to the way in which the school is viewed as 'instrumental' in providing the pupil with a 'future'. Its most important manifestation is in the way in which the (external) examination system can provide certification, and the I-rationale will exist almost independently of the actual content of the mathematics curriculum

When it comes to resistance, we find very little research has been done so far in mathematics education. The metaphor of *resistance group* is of course introduced *by* Helle Alrø and Ole Skovsmose (2003) as labeling of a specific group of students in the observed mathematics classroom. The basic behavior of the resistance group in this mathematics classroom is paying attention to what is not supposed to be paid attention to. But the metaphor is used to define and study intentions in learning – not to study resistance as a phenomenon in mathematics education.

From a socio-cultural perspective, drawing on the work of Vygotsky and Leont'ev among others, Mellin-Olsen (1987) developed a theory of Activity as a basis for mathematics education. His idea of resistance is closely linked to concepts of culture and *ideology,* defined as the set of attitudes which the individual takes from the system of groups s/he has as referents for her/his behaviour. The social environment to which the individual reacts is central in his analysis: "… social groups resisting social reproduction, such as those rejecting school, are real. Their existence has to be included in theories about such reproduction." (Mellin-Olsen, 1987:196-97).

To locate resistance Mellin-Olsen needs a concept of culture in which the resistance is produced (a political concept of culture including the concept of ideology). With reference to Giroux, he defines culture as "not simply the lived experiences within society, but the lived antagonistic relations situated within a complex of socio-political institutions and social forms that limit as well as enable action." (p.97). Mellin-Olsen's political concept of culture sees the individual as both a producer and reproducer of culture. "What we experience and will take advantage of in the context of education is the existence of resisting cultures and counter-cultures which reject the dominant ones." (p.198). His message to the mathematics teachers is about accepting resistance rather than rejecting it, about how to turn indifference and destructiveness into constructiveness, through activity. A message quite close to Illeris' but otherwise formulated (see below).

Mellin-Olsen's research interest and empirical data mainly concern children and adolescents. If we undertake research in the area of adults learning mathematics, we may find three interrelated phenomena which have to do with resistance to learning mathematics, from a socio-cultural perspective.

Three interconnected phenomena in adult mathematics education

From a huge quantitative data set in the International Adult Literacy Survey (OECD, 2003), we know that many individuals assessed to be on the two lowest levels of literacy (1 and 2) believe their skills are good or excellent and thus do not see any need to learn. In this survey, society's and the labour market's requirements with regard to adults' quantitative literacy have been defined operationally, at an international level, and OECD (1995) has given an answer to the question "What does a person need to compete successfully in a marketplace which increasingly requires technological know-how and high-level skill?" – People's functional skills required for daily arithmetic operations were assessed at five proficiency levels. Level 3 was defined as the level necessary to cope with the challenges of today's and tomorrow's society, while adults' self-assessment of their skills are based on their experiences as competent people in everyday life.

As stated above, our analysis of people's resistance to learn mathematics is based on their affective relationship with mathematics (i.e. belief, attitude and emotion). After the generalized OECD results, the following three interrelated phenomena illustrate the complexity of the subject field.

"I am not here to learn mathematics."

Firstly, adults' perspective on vocational or further education can be summarized in this statement: "I am here to be a truck driver, not to learn mathematics." Adult education is in principle post-compulsory, but the subject of mathematics is often sold as a part of a full package. It is a well-known phenomenon that students who start on vocational education are often surprised to learn that they must undertake the study of mathematics as part of their courses (Strässer and Zevenbergen, 1996; Wedege, 1999). Normally, we connect this belief/attitude with people having a poor relationship with mathematics or with people to whom mathematics is not a central or visible part of their professional identity. However, in a recent study not yet reported, Wedege found examples of this belief/attitude in people who had studied mathematics at an academic level. A group of unemployed graduate engineers started vocational retraining in university. The course was named "From graduate engineer to grammar school teacher" and the participants were very surprised that they had to study two 'heavy' mathematical subjects in algebra and calculus. They were convinced that they already had enough mathematical knowledge to teach in upper secondary school and had expected that pedagogy would be a central part of their new professional identity, not mathematics.

"Mathematics – that's what I cannot do."

Secondly, many adults' beliefs about mathematics as something beyond their reach is summarized in this statement: "Mathematics – that's what I cannot do" (Wedege, 2002). Diana Coben (2000) and her colleagues have used the term "mathematics life histories" to describe adults' accounts of their mathematical experiences throughout life - both those that are explicitly mathematical (such as being taught subtraction at school, or working out a budget as an adult) as well as those in which mathematics is implicit (such as knitting or judging distances when driving). Almost all the people interviewed remarked on the importance of mathematics and success in mathematics examinations. On the other hand, it appears that once people have succeeded in applying a piece of mathematics, it becomes 'non-mathematics' or 'common-sense'. Thus, they never perceive themselves as successful: mathematics is always what they cannot do. Wedege (2002) has called the mathematics one can do, which one does not think of as mathematics - also known as common sense *unrecognised mathematics*. Coben (2000) claims that this phenomenon, which she names “invisible mathematics” may have limiting effects on the individuals concerned and perhaps more widely, on conceptions of mathematics in society in general. Firstly, for the individuals concerned, ‘mathematics’ is rendered unattainable. It becomes, by definition, what they cannot do. Secondly, the individuals’ negative self-image as unable to do mathematics may impact on their confidence as learners, since mathematical ability is widely considered an index of general intellectual ability. Thirdly, in society at large, the image of mathematics as difficult and open only for the selected few, is maintained rather than challenged.

“No, I don’t use mathematics in work.”

A third phenomenon – connecting the two first phenomena from an analytical perspective – is the well known phenomenon that the answer is “No” when you ask adults (without a clear mathematical profile in their profession) if they use mathematics in their work (Bessot and Ridgway, 2000; Wedege, 2000). Mathematics is interwoven with technology - in technique, work organisation and qualifications. However, modern computer techniques hide the use of mathematics in the software, and mathematics as a visible tool disappears in many workplace routines. But this objective invisibility isn’t the only reason for the negative answer. As stated above adults don’t recognise the mathematics in their daily practice. They just don’t connect their every day activities with mathematics that most of them associate to the school subject or the discipline.[2] The well known activity of solving problems might serve as an example of these differences:

In what might be called traditional mathematics instruction, reality is a pretext to use mathematical ideas and techniques. The problem solving constitutes a central element and structures the teaching. The problem is primarily used to practice skills and to test skills and understandings. Thus, the problem is often solved individually by the student and it might be conceived as cheating to hand in a joint solution. The problem is formulated by the teacher, the textbook or the program. The problem has one correct solution and many wrong solutions. (Accuracy in the school and tolerance at the workplace are two different things.) Solving problems has no practical meaning: the results are not used for anything except, maybe, solving more problems. In the so-called ‘problems’ the task context is often a practical one, but the aim is to find the correct result by using the correct algorithm, not to solve the practical problem.

In the workplace, reality requires the use of mathematical ideas and techniques. The ‘problems’ result from solving a working task where the numbers are to be found or constructed with the relevant units of measurement (e.g. hours, kg, mm). It is the working tasks and functions, in a given technological context, that control and structure the process, not the ‘task’. Some of these problems look like school tasks (the procedure is given in the work instruction) but the experienced worker has his/her own routines, methods of measurement and calculation. Circumstances in production might cause deviations from the instruction or might raise or reduce the number of random samples in the quality control process. It is characteristic that problems are

[2] Differences between informal mathematics (street mathematics, folk mathematics) and school mathematics (what people learn and practice in formal education) have been investigated in a series of studies. (See, for example, Wedege, 2000, and FitzSimons, 2002).

solved in different ways and that different procedures and solutions might be acceptable. In the workplace, solving problems is a joint matter: you have to collaborate, not compete. Solving problems always has practical consequences: a product, a working plan, distribution of products, a price etc. (see Wedege, 2000).

Resistance in adult education

Resistance to learning is a well-known phenomenon in adult mathematics education. Often adults' resistance in the learning situation has to do with the fact that they have experienced themselves as competent persons without mathematics, and that mathematics has not been perceived as relevant to their life projects. This kind of resistance seems to be close to the ego-defensive type of motivation. The goal is to defend yourself and your self-perception: 'Mathematics is not important in my life'. This belief stems from the adult's experience in various communities of practice (work, family, leisure), where basic arithmetical skills have appeared to be sufficient to cope with the challenges, or where mathematics has been hidden in techniques and technologies.

Also in adult education, there has been very little research done on the subject, and resistance is often explained purely as a lack of motivation and the symptom as non-learning. However, in recent research in adult education, we may find understandings of resistance as a response to the learning situation.

Non-learning

On the basis of a very broad concept of learning from experience, Peter Jarvis's (2001) typology of people's learning from experience (non-learning, non-reflective learning and reflective learning), encompasses three types of non-learning:

- *Presumption* is an almost thoughtless and mechanical response to everyday experience – the situation is well known and we know precisely what to do. There is a sense of harmony between the biography and the individual's experience.
- *Non-consideration* is another common response to potential learning situations. The individuals realise that there is a disharmony between their biography and their experience (disjuncture) but they do not respond by adapting and learning something new.
- *Rejection* is when people have an experience but deliberately reject the possibility of learning (disjuncture). They don't wish to change their understanding of things since their whole identity is based upon it.

In Jarvis's terminology, presumption is different from the other two forms of non-learning: there is no disjuncture and no change. We would call non-consideration and rejection 'resistance'.

Situational resistance vs ulterior resistance

Some people fail assessments when a course or a training programme fails to deliver the change expected in an organisational context. This is what is directly observable at a certain level, and the explanation is usually sought in the design or delivery of the programme or in the selection procedures for it. At the micro level, tutors or trainers of adults are familiar with individual learners who continually raise objections to the teaching material, or who fail to perform as might bee expected. According to James Atherton (1999), their behaviour is most commonly explained as lack of motivation, ability or aptitude. However, he finds that in many cases these explanations are correct, but not exhaustive. Most failures to learn are products of a number of interacting variables, and Atherton submits that a degree of personal resistance – different in kind from "lack of motivation" – is to be considered along with other factors.

His article "Resistance to learning" is derived from an interview based study carried out with 124 participants – with established ideas and practices – on in-service training programmes in social services. In his investigation, it was hypothesised that resistance is itself symptomatic of a situation where the learning is experienced as *supplantive*, i.e. the material replaces or threatens knowledge or skills which have already been acquired, rather as *additive* learning.[3]

The researcher was a member of the tutorial team in the 25 courses/training programmes being studied. The interviews were recorded as part of the evaluation procedure. One of the questions went like this: "What areas of the course learning have caused you to re-think your previous approach to your practice?" (Atherton, 1999:80) This was the question that most explicitly addressed the issue of supplantive learning. The respondents articulated a loss of certainty, which was provoked or triggered by the experience of the course. The diversity of the triggers was surprising to the researcher and there were very few respondents who reported none.

Atherton opposes *situational resistance* provoked by the immediate situation (boring, too difficult, insufficient pre-course information etc.) to *ulterior resistance* of supplantive learning provoked by underlying concerns. The interaction of the two kinds of resistance is complex.

Defence vs resistance

In Illeris's general theory of learning, a basic distinction is made between non-learning caused by mental defence and by mental resistance: "the defence mechanisms exist prior to the learning situation and function re-actively, resistance is caused by the learning situation itself as an active response." (Illeris, 2003b:404). Defence is directed to the psychological process of acquisition in learning (the cognitive-affective dimension in figure 1), while resistance is directed to the social/ environmental dimension. Defence is a barrier to learning (relevant or not). Resistance implies the possibility of learning. According to Illeris, resistance contains a very strong learning potential for accommodative and even transformative learning – what we call supplantive learning for the purpose of this paper (see note 3). From a broader perspective, people's attitudes and self-perception in relation to mathematics may be socially generated through their lived experiences. (Wedege, 2002).

Examples of motivation and resistance in two women's lives

From the perspective of lifelong education it is important to create knowledge about the conditions of adults' learning processes and the possible stability, change and transformation of these conditions. According to Evans (2000) adults' resistance to

[3] Atherton's two terms, additive learning and supplantive learning, could be related to Piagetian terminology. There we find theoretical frameworks (or terminology) with different levels of learning: cumulative, assimilative, accommodative, transformative or expansive learning (cf. Illeris, 2003b). We understand *additive learning* as cumulative and assimilative learning; and *supplantive learning* as accommodative and transformative.

doing mathematics problems in a specific situation results from a range of features and processes and it needs to be understood as an effect of one's different history of positioning in learning mathematics. The positioning is influenced – but not determined – by class and gender. The subject's positioning "results both from the general social availability of positions in discourse, and from the investment for the particular person to take up a specific position." (Evans, 2000:133). In this section analysis of interviews with two women will serve as examples of changing conditions for motivation or resistance to learn mathematics and – at the same time – illustrate the conceptual framework presented above.

Ruth – 75 years

In the account of the mathematics life history of a 75 year old woman, Wedege (1999) identified changing conditions of Ruth's learning process in different contexts through her lifetime, using terms like *blocks, resistance, rationale, motivation*. It was argued that *habitus* (Bourdieu, 1980) was an important generator of resistance and motivation.[4] In order to try out the usability of our developing theoretical framework defined above as an analytic tool, we have read the transcribed interview again.

This woman, Ruth, had the lowest grade in mathematics at the leaving in secondary school, but has always been very competent in arithmetic. At fifty Ruth went to the technical school where she had the highest grade in mathematics. However, she has always looked upon her self as someone not knowing and not doing mathematics. Wedege remarked in her analysis of the interview that Ruth's motivation to be a draughtsman made her overcome her blocks, but not her resistance against learning mathematics. Her intentions had changed but not her dispositions to mathematics incorporated through her lived life. According to the theory of Bourdieu, these were based on habitus of a girl born 1922 in a provincial town as a saddler's daughter, that of a pupil in a school where arithmetic and mathematics were two different subjects at a time where it was "OK for a girl not to know mathematics", and habitus of a wife and mother staying home with her two daughters is a basis of actions (and non-actions) and perceptions. Habitus as a system of dispositions generating practices and representation undergoes transformations but otherwise durability is the main characteristic (Wedege, 1999:222).

With the terminology introduced above, we can analyze the situation like this: Ruth's motivation to learn mathematics (to be a draughtsman) made her overcome her defence but not her resistance against learning mathematics. She rejects the opportunity to learn:

> Ruth: … a slide rule. Yes, we had to learn to use that. But I worked everything, <u>everything</u> out manually. I multiplied six figure numbers and there were six rows of them under that. I finished it before the others had finished pushing this ruler around. (Wedege, 1999:215-216)

Her motive in the learning process and her reason for learning mathematics were strictly connected to the wish of being a draughtsman. Her motivation was

[4] The main purpose of the article "To know or not to know mathematics – that is a question of context" (Wedege, 1999) was to discuss a possible combination of Lave's theory of situated learning with Bourdieu's theory of habitus and their suitability for analysing adults knowing or not-knowing mathematics in different situation contexts.

performance (to pass the examination), rather than mastery (of the slide rule. or of mathematics), although there would also be good reasons for the motivation to be mastery.

> Problems to do with figures from tables and statistics that are converted into graphs and curves. This is applied mathematics but as a draughtsman Ruth did not experience it as such. It would almost seem that her perception was: what can be used in practice is not mathematics. In the mathematics lesson it is called "measurements": at the studio it is called "scale" (...) In her perception, mathematics is needed by the architects, not by the draughtsmen. (Wedege, 1999: 218)

Thus the learning was purely additive, not supplantive. Ruth learned to pass the examination but didn't change her belief about mathematics as something not relevant and mathematics as what she couldn't do.

Susan – 35 years

Susan, a 35 year old female student from a mathematics course at a College for Further Education – and also a mother – was interviewed in the context of an English project which explores adult learners' relations with mathematics.[5] Unlike Ruth, she had chosen the subject of mathematics having a perspective to do so. The focus of the interview was her motivation to study mathematics:

I And what made you come and do this course at the college?

Sus It was the one thing that I wasn't able to achieve throughout the years that I've been trying to study. […] So I decided to come here, one because it was closer, but two, because I could do one thing that I wanted to at least try and accomplish at long last.

I So tell me why it was maths?

Sus Because I hadn't accomplished maths. And to do anything that I wish to do in the future I have to have maths GCSE.

Susan told that she had been trying to learn mathematics for twenty years without any success. Her dyslexia and depression from time to time gave her specific difficulties. Now she tried once more. She needed a mathematics certificate to enter further education. Performance goals motivated her, but her learning mathematics is not only a matter of performance (getting a certificate). It is obvious that Susan overcame her resistance with mastery as motivational orientation. When the interviewer asked her if there was any particular thing that turned her on to maths again, she pointed to her daughter[6]:

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[5] In the workshop "Adult motivations behind returning to study numeracy in formal settings" at the 11th international conference on Adults Learning Mathematics in Kungälv, Sweden 2004, the research team Jon Swain, Elizabeth Baker, Debbie Holder and Barbara Newmarch asked the participants to help code the transcribed data from the interview with Susan. Later they accepted the data to be used for the purpose of this paper.

[6] Preliminary results from an ongoing evaluation of Preparatory Adult Education by the Danish Institute of Evaluation show that helping one's children with their school mathematics is a very central motive

Sus I was very worried that once she got to secondary school there was no way I was going to be able to help her. And that made me feel inadequate.

In the research project the possibility of people changing identities through education was also a focus. The interpretation that mastery motivation dominates in Susan's learning processes is supported by the following sequence:

I OK. Tell me, how would you describe yourself? Would you describe yourself as a parent? A student?

Sus A mother. That's it. Mother.

I You also come to the college and you are doing a course here. Would you see yourself also as a student?

Sus No, just a mother.

I Just a mother. Do you think being a mother involves learning and studying, perhaps?

Sus Yeah. I don't want my daughter to be confused and not be able to ... to not learn something, and me let her down.

We only have a few pieces from the puzzle of Susan's mathematics life history. Nevertheless it seems like she is really struggling to learn mathematics, to pass the examination, yes, but most to be an example of her daughter. Thus the learning was not purely additive, also supplantive. Susan learned to pass the examination and changed her belief about mathematics as something she couldn't do.

Conclusion

In adult mathematics education, non-learning and not knowing are important issues as well as learning and knowing. Although adults have mathematics-containing competences developed in work, it appears that their beliefs about mathematics are primarily related to their school experiences, and mathematics is experienced by many adults as something that others can do, but that they themselves can't do and don't need. Many adults who start on vocational education are surprised that the programme includes teaching in mathematics. They have experienced themselves as competent persons without mathematics and mathematics has not been perceived as relevant to their life projects. Thus their reactions may be resistance in the learning situation.

Resistance to learning is a well-known phenomenon in adult education, however there is very little research done on the subject, and resistance is often explained purely as a lack of motivation and the symptom as non-learning. However, Atherton (1999) identifies a phenomenon of personal resistance resulting from the learning situation, from his investigations within in-service professional training programmes. In his

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for adults to overcome their barriers against returning to learn mathematics. The subjective need for learning mathematics differs from politicians' and industry's requirement to qualification for the labour market. (See also FitzSimons, 2003.)

general theory of learning, Illeris (2000b) distinguishes defence that exists prior to the learning situation and functions re-actively, and resistance caused by the learning situation itself as an active response. According to Illeris, resistance contains a very strong learning potential for accommodative and even transformative learning (supplantive learning). On the basis of this assumption, we investigate adults' motivation and resistance to learn mathematics as interrelated, starting to develop a conceptual framework (Evans and Wedege, 2004).

While the conceptions of resistance in education in the work of Atherton (1999), Illeris (2003) and Jarvis (2001) are psychological, the approaches in the work of Mellin-Olsen (1987) and of Giroux (2001) are socio-cultural. Concepts of dominant ideology, social reproduction and resistant cultures are central in these theoretical frameworks. To Mellin-Olsen, the existence of Folk mathematics (people's everyday mathematics) demonstrates that mathematics is both produced and reproduced, and the critical question "What counts as mathematics" asked by FitzSimons (2002) makes visible the power relations in adult and vocational education.

Wedege (1999) has tried to make sense of the contradiction between competence and resistance by analytically expanding the context for knowing mathematics from people's experiences and perspectives in the learning situation to also include their habitus as a system of dispositions generating practices and representations. On the basis of these empirical and theoretical studies, further research on adults' resistance to learn mathematics will be done. A theoretical framework will be developed, from a socio-cultural perspective, as part of our ongoing work to develop a framework for understanding the conditions of adults' learning processes in formal education and in everyday life.

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